DOCUMENT RESUME

ED 147 773 CS 003 815

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TITLE Modification of the Impulsive Cognitive Style: A Review.
PUB DATE 77
NOTE 21p.; Study prepared at Kansas State University

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Behavior Change; *Cognitive Processes; *Cognitive Style; Elementary Secondary Education; *Literature Reviews; Modeling (Psychological); Psychological Studies; Reinforcement; Teaching Techniques

ABSTRACT

The impulsivity-reflexivity dimension of cognitive style is a variable that significantly affects a learning/teaching situation. Previous investigations have suggested, for example, that learners with an impulsive cognitive style are at a disadvantage in problem-solving situations. This review focuses on investigations into four specific procedures designed to modify an impulsive problem-solving disposition: reinforcement techniques, modeling techniques, direct instruction in reflective thinking, and attention to appropriate stimuli. The evidence reviewed suggests that each of the techniques holds some promise, but it is not clear which procedures are most effective. Conclusions that can be drawn from the research are summarized, and an additional line of exploration is proposed. (Author/AA)

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MODIFICATION OF THE IMPULSIVE COGNITIVE STYLE: A REVIEW

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It can be readily agreed that a thorough knowledge of individual differences is essential for teachers as they endeavor to cope with the needs of each learner in the classroom. Since individual differences have an integral relationship with comprehension and learning, no realistic system of classroom instruction can afford to overlook them (Ausubel, 1968).

Cognitive style dimensions describe one set of individual differences which affect the general mode of cognitive functioning and problem-solving behavior in every learner. In describing the concept of cognitive style, Santostefano, Rutledge, and Randall (1965) proposed:

> That when perceiving an individual's cognition is active, not passive, selecting, sorting, and organizing information according to particular system principles which are influenced by motivational and personality factors. (p. 58)

One dimension of cognitive style, impulsivity-reflectivity, has yielded fruitful results for researchers in their efforts to better understand the processes involved in the acquisition of learning. Impulsivity-reflectivity was identified in early studies by Kagan, Moss, and Siegel (1963) and by Kagan, Rosman, Day, Albert, and Phillips (1964) in their investigations of how children conceptualize and process information in a learning situation.

Kagan, et al (1964) postulated that this dimension of cognitive style related to the consideration of available solution alternatives in situations of high response uncertainty. In such a situation, the child must evaluate each possibility differentially. An impulsive child tends to act upon his initial response with little reflection, to process an incorrect hypothesis, and to issue a solution with little or no critical analysis with regard to its potential accuracy. On the other hand, a reflective child delays before acting on a solution hypothesis, actively considers possible alternatives,

and compares their validity. A reflective child acts as if he cares that his first response be as close to correct as possible (Kagan, 1966).

From this baseline research, Kagan (1965b) developed the Matching Familiar Test (MFF) which has become a standard measure of impulsivity-reflectivity in research studies. The MFF is individually administered and consists of twelve items, each presenting the subject with a standard and six variants of it. The task of the subject is to select the variant identical to the standard. Using a double split median, subjects are classified as impulsive or reflective. Those subjects scoring below the median for response time and above the median for errors are termed impulsives. Conversely, reflectives are those subjects scoring above the median for response time and below the median for errors.

Although Bjorklund and Butter (1973) found that the preferred cognitive style of an individual is independent of general behavior, several personality correlates have been associated with impulsivity-reflectivity. Kagan (1965a) and Kagan (1966) observed that reflective children preferred sedentary tasks requiring great persistence and strong concentration in order to master them and avoided unfamiliar social situations or potentially dangerous play activities such as swinging too rapidly.

On the other hand, Kagan indicated that impulsive children were likely to become easily distracted in school tasks and chose tasks of less difficulty and sustained their attention on them for shorter durations of time. They also enjoyed social interaction and seemingly disregarded potential risk with play activities. Additional research by McKinney (1975b) demonstrated that in learning situations, though cognitive style was independent of general behavior, impulsive children were viewed less favorably by teachers than reflective children.

Other studies have further delineated the actual or perceived differences between impulsive and reflective children. With regard to attentional strategies on learning tasks, it has been consistently found the reflectives are able to selectively attend to relevant versus irrelevant information while impulsives do not seem to possess that ability (Ault, Crawford, and Jeffrey, 1972; Weiner and Berzonsky, 1975). Additionally, in studies examining frequency of looking behavior on MFF tasks (Ault, et al, 1972; Drake, 1970; Siegelman, 1969), it was found that reflectives, regardless of age, examined more MFF variants and made more fixations per task.

Another difference between impulsives and reflectives investigated by various researchers (Adams, 1972; Ault, 1973; McKinney, 1973; 1975a; Nuessle, 1972) was that of problem-solving strategies at various levels of cognitive development. All investigations were consistent in their findings that impulsives demonstrated less refined strategies in the problem-solving tasks confronting them. Additionally, older impulsives showed performances equivalent to that of younger reflectives indicating developmental differences between subjects of varying cognitive style.

Reflective subjects have also demonstrated superior performance over impulsive subjects on tasks involving memory and thinking. In particular, McKinney and Banerjee (1975) and Siegel, Kirasic, and Kilburg (1973) observed that impulsives displayed poorer performances on tasks requiring visual recognition memory. Klein, Blockovich, Buchalter, and Huyghe (1976) found that reflectives did better than impulsives on convergent thinking tasks. Finally, Fuqua, Bartsch, and Phye (1975) showed that impulsives scored lower than reflectives on measures of creativity.

Taken together, these studies show that cognitive style patterns influence the characteristic manner in which children cope with intellectual

tasks requiring problem-solving behavior. Consistently, the findings of these investigations have demonstrated that impulsive children seem to be at a disadvantage in learning situations. Not only do reflective children demonstrate superior performances on many intellectual tasks, but they are also perceived more favorably in their attempts to solve a problem.

One area of investigation that has been pursued by various researchers in an attempt to deal with the seeming disadvantage of impulsives in learning situations is the modification of that cognitive style. The premise behind these experimental studies is that if an impulsive learner was trained to respond more reflectively in a problem-solving situation, then his chances of meeting success in the task would be greatly enhanced. A wide variety of modification efforts have been attempted and investigated by various researchers. Included in these efforts are the use of reinforcement contingencies, modeling, direct teaching of efficient scanning strategies, and training in attention to distinctive features during problem-solving (Messer, 1976).

Using Reinforcers to Modify Impulsivity. Investigations of reinforcement strategies have centered on contingencies aimed at either increasing response time and/or decreasing error rates of impulsive children in problem-solving situations. Massari and Schack (1972) examined the effect of increased anxiety induced by negative reinforcement on reflective and impulsive black first graders. Subjects were assigned to either a positive or negative social reinforcement condition. Although reflective subjects made more correct responses than impulsives, both groups made fewer errors in the negative condition. It was concluded that a high density of negative feedback induces children to modify their impulsive behavior.

Errickson, Wyne, and Routh (1973) investigated the use of a token response-cost contingency on the modification of EMR subjects identified as impulsives.

Children, aged 11 to 16 years, were administered the standard MFF or a response-cost condition. In the response cost administration, chips were removed from a starting pool of six each time the subject produced an incorrect response. The chips functioned as token reinforcers as they could be exchanged for candy or gum. The response-cost procedure was found to be effective both in reducing errors and in increasing response latencies.

Additional studies have explored the use of reinforcers to modify impulsivity. Briggs (1968) found that using colored lights as reinforcers to increase fourth graders' response time led both to longer latencies and fewer errors. Weinberg (1969) found that social approval and tangible rewards were effective reinforcers for increasing response latencies but not error rates. Reinforcing only for a decrease in errors, Scher (1971) found that, although latencies were affected, no significant changes occurred in error rate.

In summary, it appears that extrinsic reinforcement of both delayed response time and decreased errors may hold promise as one approach to modifying an impulsive cognitive style. However, the extended, long term effect of this form of modification, and transfer to tasks other than the MFF is, as yet, uncertain.

Using Modeling to Modify Impulsivity. A number of researchers have investigated the modification of impulsivity through the use of models. Kagan, Pearson, and Welch (1966) trained impulsive subjects to identify with reflective tutor models. In contrast, another group of impulsive subjects were trained to perceive low similarity with tutor models. Findings indicated that although response time on the MFF increased significantly, error scores showed minimal change. It was concluded that reflectivity training that involved modeling held potential for the modification of impulsive behavior.

In another study of the effects of modeling behavior on the modification of impulsivity, Debus (1970) assigned impulsive subjects to form model conditions and a control. All models were sixth graders of the same school who were reflectives and were trained for each of the modeling conditions. The patterns of modeling behavior were a reflective model, an impulsive model, a change model whose response pattern changed halfway through the experiment from impulsive to reflective behavior, and a dual model consisting of two models, one impulsive and one reflective.

Debus found that, as expected, the impulsive model produced no changes in the subjects. However, the observation of the reflective model produced an increase in response time for both boys and girls. With the dual model, and particularly the change model, girls showed an increase in response latency. The subjects observing the contrast provided by the change model showed the most durable effects. Additionally, the subjects showing an increase in response time also showed a decrease in the number of errors as compared to those whose response time did not increase.

Ridberg, Parke, and Hetherington (1971) examined the effect of film-mediated models on impulsive and reflective fourth grade boys. Each subject was exposed to a film model displaying a cognitive style opposite of his own. The film model was a nine-year old male responding to MFF items in an impulsive or reflective manner. To assess change, subjects were retested on the MFF after one week. The findings resulting from the retest showed that both response time and error scores were modified. Reflective models induced impulsive subjects to increase response time and decrease errors. Impulsive models caused reflective subjects to increase errors and response time. Ridberg, Parke, and Hetherington attributed the increase in response time for reflectives to a possible conflict between the impulsive modeling

of the film and their already successful cognitive style. It was suggested that this conflict may have disrupted the usual deliberate, accurate approach of reflective subjects.

Other studies have investigated the effects of modeling on impulsivity-reflectivity. Denney (1972) showed that a female adult performing a conceptual task in an impulsive or reflective manner significantly changed the cognitive style of second grade subjects. Using peer models, Cohen and Przybycien (1973) demonstrated that impulsive subjects viewing reflective models changed learning style. In a second, related study, Cohen and Przybycien (1974) found that sociometrically selected peer models had a significant influence on the modification of fourth and sixth graders impulsive response style. They concluded that age-appropriate, similar status models may be an effective force in altering an impulsive cognitive style, particularly concerning error scores.

Meichenbaum and Goodman (1971) combined aspects of modeling with a cognitive self-guidance strategy to investigate the effect of such a program on the problem-solving behavior of impulsive second graders. In the initial phase of the study, subjects were randomly assigned to one of three conditions: cognitive modeling and self-guidance, a minimal modeling condition, and a control. In the cognitive self-guidance condition, the subject observed the examiner talking aloud to himself while performing problem solving tasks of varying difficulty. The subject then patterned this overt verbalization, gradually fading to covert self-guidance while engaged in problem-solving. MFF results, immediate and delayed, indicated a significant increase in decision time for the cognitive self-guidance group over the minimal modeling control groups. However, no corresponding error decrease was noted. It was concluded that a cognitive self-guidance training program can alter at least one aspect of impulsive behavior.

In the second phase of this study, Meichenbaum and Goodman attempted to discover which specific components of the treatment program were most efficacious in modifying an impulsive conceptual tempo. Cognitive modeling alone was compared to cognitive modeling plus self-instruction training. The cognitive modeling plus self-instruction condition was found to be most effective in altering decision time and reducing errors. In contrast, the modeling alone condition decreased response time but not error rate. In a more recent study, Jacobs (1974) corroborated Meichenbaum and Goodman's findings on the efficacy of modeling plus cognitive self-instruction in the modification of impulsive problem-solving.

In summary, the presentation of contrasting impulsive and reflective models and age-appropriate models are both effective in modifying an impulsive cognitive style. Of particular interest is the finding that modeling linked with instruction in a cognitive self-guidance strategy is effective in both the reduction of errors and alteration of response latencies. The maintenance over time of a modeling-acquired reflective style warrants further examination.

Using Instruction in Efficient Scanning Strategies to Modify Impulsivity.

Direct instruction of impulsive children in efficient problem-solving behavior is another modification strategy that has been investigated. Heider (1971) predicted that teaching impulsive children to adopt an appropriate task strategy would be more effective in altering an impulsive tempo than either increased anxiety over errors or forced delay of response. Seven year old middle class (MC) and lower class (LC) subjects were assigned to an MFF task in each of four modes: control, forced delay, increased motivation, and specific task strategy instructions. For LC impulsive subjects, the task strategy instructions significantly reduced errors on the MFF. In

contrast, none of the intervention strategies significantly altered the performance of the MC group who seemed to possess the appropriate reflective behavior at the outset. It was concluded that direct instruction in the heuristics of information processing is an effective means of modifying impulsivity, at least with LC impulsive subjects.

Albert (1970) compared impulsive second and third grade subjects assigned to a delayed instruction treatment with subjects instructed to scan stimuli in a reflective manner, and subjects in a control group. Those subjects who received the scanning instruction demonstrated an increase in response time and a decrease in errors over the other two groups. However, the reflective training did not transfer to three other discrimination tasks which differed from the training task.

In a similar study, Egeland (1974) compared a group of impulsive second grade children who were taught to use an efficient scanning technique with a group trained to delay responses, and a third group receiving no training. Both training procedures were effective in reducing the number of MFF errors immediately after training. However, two months after training the scanning group continued to make few errors while the delayed response group increased in errors significantly. Egeland concluded that training in efficient scanning techniques appeared to be a more "durable" modification procedure with impulsive children than delayed response training.

Zelniker, Jeffrey, Ault, and Parsons (1972) speculated that a variation of the MFF task might serve to modify third grade boys and girls performance on subsequent MFF administrations. Reflective and impulsive subjects were randomly assigned to either the MFF condition or a variation of the MFF, the Discriminating Familiar Figures (DFF) test. The DFF consists of a standard and six figures, five of which are identical to the standard. Thus the

subject's attention is focused on analysis of the variants rather than the standard.

As predicted, impulsive subjects receiving the DFF treatment displayed more effective search strategies on a follow-up administration of the MFF. Conversely, the control subjects manifested an increase in errors from the pre-MFF to the post-MFF. Therefore, with a variation of the MFF task in a training sequence, impulsive subjects were able to successfully modify their scanning strategies on subsequent MFF administrations.

In summary, direct instruction in reflective scanning strategies appears to be an effective approach to modifying impulsive behavior, at least on MFF tasks. The transfer and maintenance of a newly acquired reflective strategy has not been confirmed with classroom problem-solving tasks that differ from the MFF. Certainly this line of research warrants further exploration if current findings are to be applied to the variety of problem-solving encounters that arise in the classroom milieu.

Using Distinctive Feature Training to Modify Impulsivity. Another modification procedure that has been investigated involves training impulsive children to attend to the distinctive feature of a stimulus array in a reflective manner. Zelniker and Oppenheimer (1973) predicted that differentiation training would alter impulsivity and increase distinctive features learning. Impulsive kindergartners were randomly assigned to either a matching to sample training condition or a differentiation treatment involving black line drawings. Following the treatment, subjects were randomly assigned to three transfer conditions. As expected, the differentiation training groups made significantly fewer errors on the transfer tasks than the matching to sample group. It was concluded that differentiation training was an effective way of improving impulsive childrens performance on discrimination problems.

In a related study, Zelniker and Oppenheimer (1976) investigated the transfer effect of four training methods designed to alter impulsive kindergartners' problem-solving behavior. Subjects were randomly assigned to five groups; four treatment conditions and a control. One of the four training conditions involved a matching cards task comparable to the MFF; in contrast, the other three conditions emphasized differentiation training across three novel transformations of black line drawings. Although the four training procedures all proved to be beneficial, the differentiation training procedures were significantly more effective than the matching conditions for impulsives on the transfer tasks. It was concluded that varying relevant details between training problems focused the subjects attention on stimulus features requiring discrimination for effective problem-solving.

Finally, in a unique study which compared the effects of distinctive feature training with modeling and systematic scanning strategies, Orbach (1977) confirmed the research of previous investigators that all three techniques were successful in modifying an impulsive cognitive style. Additionally, he found that the visual detailing strategies were more efficient in changing impulsivity than the modeling techniques, and that the distinctive feature training was superior to both.

In summary, although not widely researched as yet, distinctive feature training seems to be a productive approach to the modification of impulsivity, particularly on tasks similar to the MFF. Continued exploration of the maintenance and transfer aspects of distinctive feature training in comparison with other impulsivity modification procedures seems warranted.

Discussion

Research into the impulsivity-reflectivity dimension of cognitive style demonstrates that it is one individual difference which affects the disposition of a learner as he approaches a problem-solving situation. Impulsives and reflectives characteristically display differential performances in such intellectual tasks, and consistently, impulsives are seemingly placed at a disadvantage in classroom learning situations.

Investigations aimed at generating and evaluating procedures for the modification of impulsivity have met with a modicum of preliminary success. Individual studies using reinforcement schedules, modeling techniques, direct instruction in reflective thinking, and attention to appropriate stimuli all seem to hold some promise for improving the impulsive student's performance on learning tasks. It is not clear as yet which modification procedures are most effective and stable over time. Nor is it clear which strategies best lend themselves to direct application in the classroom.

In summary, the following conclusions may be derived from the modification studies reviewed:

1. Reinforcement techniques can induce change in impulsivity by increasing response time and/or decreasing errors, at least on a short term basis.
2. Reflective modeling significantly modifies impulsive behavior. In particular, such modeling in combination with training in self-guidance appears to be most effective in altering impulsivity.
3. Direct instruction in reflective scanning strategies successfully alters an impulsive search behavior, at least on problem-solving tasks similar in nature to the MFF.

4. Training impulsive learners to seek out relevant distinctive features in discrimination tasks effectively improves their performance in problem-solving situations.

The results of the studies reviewed appear to hold promise in modifying impulsivity. However, further research needs to be conducted to investigate both the long-term effects of modification and its transfer to other problem-solving tasks, particularly classroom learning situations.

One other possibility warrants exploration concerning the enhancement of the learning strategies of individuals with an impulsive cognitive style. This paper has summarized research aimed at training impulsive learners to be more reflective. Neglected in these investigations is an alternate route, seeking out the types of instructional materials and approaches which would be most compatible with the existing cognitive style of the learner. The tact investigated here implies that the child must be changed to suit the available learning environment. The alternative proposes modifying the environment to fit the child.

Two studies (Erickson and Otto, 1973; Readence and Baldwin, 1977) have tested the hypothesis that using alternative instructional materials or methods would result in differential achievement in problem-solving tasks. Both studies involved the variable of reading, a perceptual task presenting the learner with a situation of high response uncertainty.

Erickson and Otto (1973) explored the effects of high similarity versus low similarity in learning lists of words. The results revealed that, while impulsive subjects showed little difference in word recognition regardless of list similarity, reflectives performed significantly better in word recognition tasks by learning words from lists of high similarity. Readence and Baldwin (1977) investigated the performance of impulsives and reflectives

in vocabulary and comprehension achievement under either an analytic or a synthetic approach to phonics instruction. The results of the study showed that reflectives in a synthetic approach performed significantly better than impulsives only in vocabulary while, under an analytic approach, the reverse was true; reflectives were significantly better on the variable of comprehension.

The combined results of these two studies point to the merits of investigating the hypothesis of matching the instructional environment to the cognitive style of the learner. While these studies only scratch the surface of this hypothesis, and while they reveal positive results only for reflectives, further, in-depth research in this area is warranted. The possibility exists that such research, in combination with further exploration of the previously cited research needs in modifying impulsivity, could provide some insight into more effectively dealing with this very significant variable of individuality in learning situations.

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